Amendments to the Drawings:

The attached sheet of drawings includes changes to Fig. 9. This sheet, which includes Fig. 9, replaces the original sheet including Fig. 9.

Attachment: Replacement Sheet: Fig. 9

REMARKS

Claims 1-4, 6-12 and 14-40 are pending. By this Amendment, Fig. 9 is replaced pursuant to the attached drawing sheet, and the specification and claims 1, 9, 17, 27 and 37-40 are amended. Claims 1 and 9 are amended to recite features supported in the specification at, for example, page 20, lines 18-27 and Fig. 2. Claims 17, 27 and 37-40 are amended to recite features supported in the specification at, for example, page 24, line 4 – page 25, line 17 and Figs. 1 and 11. No new matter is added by any of these amendments.

Applicant appreciates the courtesies extended to Applicant's representative by Examiner Siangchin during the March 28, 2005 telephone interview.

Reconsideration based on the following remarks is respectfully requested.

I. Amendment Entry after Final Rejection

Entry of this amendment is proper under 37 CFR §1.116 because the amendments: a) place the application in condition for allowance for all the reasons discussed herein; b) do not raise any new issues requiring further search or consideration; c) place the application in better condition for appeal if necessary; and d) address formal requirements of the Final Rejection and preceding Office Action. The foregoing amendments do not raise any new issues after Final Rejection. Accordingly, Applicant respectfully requests entry of this Amendment.

II. The Drawings Satisfy All Formal Requirements

The Final Office Action objects to the drawings based on informalities. Figure 9 is replaced pursuant to the attached drawing sheet based on the Examiner's helpful suggestions. In particular, the pattern shown in area 901 is replaced with a pattern that also conforms to a mirror pattern arrangement of area 801 in Fig. 8, as projected onto board 606 in Fig. 6, and described in the specification, for example, at page 25, lines 2-9. Withdrawal of the objection to the drawings is respectfully requested.

III. The Specification Satisfies All Formal Requirements

The Final Office Action objects to the specification, particularly the Title, based on informalities. The Title has been amended to obviate the objection, and the specification has been amended to correct minor informalities. Withdrawal of the objection to the specification is respectfully requested.

IV. Claims 1-4 and 6-8 Define Patentable Subject Matter

The Final Office Action rejects claims 1, 4 and 8 under 35 U.S.C. §103(a) over "A Multibaseline Stereo System with Active Illumination and Real-time Image Acquisition, IEEE, 1995 by Kang *et al.* (hereinafter "Kang") in view of U.S. Patent 6,044,165 to Perona *et al.* (hereinafter "Perona"); claims 2, 3 and 7 under 35 U.S.C. §103(a) over Kang and Perona and further in view of "Recent Progress in Coded Structured Light as a Technique to Solve the Correspondence Problem: A Survey", *Pattern Recognition*, vol. 31, no. 7, pp. 963-982, 1998 by Batlle *et al.* (hereinafter "Batlle"); and claim 6 under 35 U.S.C. §103(a) over Kang and Perona and further in view of U.S. Patent 6,125,197 to Mack *et al.* (hereinafter "Mack"). These rejections are respectfully traversed.

Kang and Perona, alone or in combination, do not teach or suggest an image processing apparatus comprising a three-dimensional image pickup part that includes a projecting part that projects a pattern along a direction of an optical axis, a first image pickup part that picks up an intensity image and a projection pattern image deflected from the direction of an optical axis of the projecting part by a half mirror, and a second image pickup part that picks up the projection pattern image from a direction different from the optical axis of the projecting part, the three-dimensional image pickup part creating first range information based on a pattern picked up by the second image pickup part, geometric transformation part that performs geometric transformation for the intensity image picked up by the first image pickup part, based on the first range information; a storage part that stores, as initial frame data, an initial image of frame data in a time-series transformed by the

geometric transformation part, a frame data comparison part that makes comparison between successive frame data images in the time-series transformed by the geometric transformation part, and an image processing part that retrieves only differential data between successive frame data in the time-series as storage data based on a result of the comparison of the frame data comparison part of the initial frame data and frame data subsequently transformed in the time-series, as recited in claim 1. These reasons apply by extension to claims 2-4 and 6-8 based on their dependence from claim 1.

Instead, Kang discloses an illuminated four-camera system for stereo visualization. In particular, Kang teaches computational schemes to match points at a particular depth by rectifying images for holography mapping (§§4.2 and 4.3 at page 90, col. a – page 91 col. b and Figs. 5 and 6 of Kang).

Further, Perona discloses a handwriting tracking system. In particular, Perona teaches a camera 100 aimed at a paper surface 102 to obtain a video image of a pen 104. Perona further teaches a preprocessor 110 that adjusts the camera 101. The preprocessor 110 filters and submits the image to a tracker 112 to process the pen movement and submit the output as a symbolic or graphical representation to a recognition unit 140 for verifying represented characters (col. 3, lines 28-65 and Fig. 1 of Perona).

Batlle does not compensate for the deficiencies of Kang and Perona outlined above for claim 1. Nor does Batlle teach, disclose or suggest the additional features comparing the frame data images in the frame data comparison part as provided in claims 2 and 3, or creating second range information by deriving a correspondence between intensity information obtained by the first and second image pickup parts for an area where the change of the pattern picked up by the projecting part is less than a predetermined value, as provided in claim 7. Instead, Batlle discloses techniques for codification of projected patterns. In particular, Batlle teaches transformation from a captured point P_1 based on an object point P_0 to a projected point P_2 using a global coordinate system O (§§4.1-4.3 at pages 965-966 of

Batlle). Additionally, Batlle teaches projecting patterns of laser beam dots, captured by cameras either simultaneously with filters or else sequentially (§6.1 at pages 969-971 and Fig. 3 of Batlle).

Also, Mack does not compensate for the deficiencies of Kang and Perona outlined above for claim 1. Nor does Mack teach, disclose or suggest the additional features, including a light source to emit light of an invisible region of a wavelength band, and image pickup filters for transmitting and cutting off light of the invisible region, as provided in claim 6. Instead, Mack discloses converting stereoscopic images into three-dimensional models. In particular, Mack teaches a 3-D imaging device system 10 having left and right imaging devices 12, 13 to capture an image of a target object, a light device to project a light beam, a diffracting device 17 to split the beam into a structured pattern of lines, a filter 18 to code the lines, and a computing device 19 to process the imaging data into a stereoscopic image (col. 3, line 43 – col. 4, line 59 and Fig. 1 of Mack). Also, Mack teaches that the light source 16 may emit light in the infrared region rather than visible light, particularly when obtaining textural data (col. 5, lines 25-32, col. 6, lines 15-39 and Fig. 2 of Mack).

Further, there would not have been proper motivation to combine features related to the rectified homography of Kang with the pen movement tracking system of Perona, or additionally with the coordinate transformation and pattern projection of Batlle, or the coded structured light of Mack. These disparate references address such separate and distinct concerns that an artisan of ordinary skill would lack any incentive to combine their respective teachings, despite the extensive rationale presented in the Final Office Action. Nor has the Final Office Action established sufficient motivation for a *prima facie* case of obviousness.

For at least these reasons, Applicant respectfully asserts that independent claim 1 is now patentable over the applied references. The dependent claims are likewise patentable over the applied references for at least the reasons discussed as well as for the additional

features they recite. Consequently, all the claims are in condition for allowance. Thus, Applicant respectfully requests that the rejections under 35 U.S.C. §103 be withdrawn.

V. Claims 9-12 and 14-40 Define Patentable Subject Matter

The Final Office Action further rejects claims 9, 11, 12, 14 and 16 under 35 U.S.C. §103(a) over "Online Handwriting Data Acquisition Using a Video Camera", *Fifth Intern'l Conference on Document Analysis and Recognition*, September 1999 by Bunke *et al.* (hereinafter "Bunke") in view of U.S. Patent 5,764,383 to Saund *et al.* (hereinafter "Saund") and further in view of Mack; claims 10 and 15 under 35 U.S.C. §103(a) over Bunke, Saund and Mack and further in view of Batlle; claims 17-20, 27-30 and 37-40 under 35 U.S.C. §103(a) over Bunke in view of Saund; claims 21-24, 26, 31-34 and 36 under 35 U.S.C. §103(a) over Bunke and Saund and further in view of U.S. Patent 5,668,897 to Stolfo; and claims 25 and 35 under 35 U.S.C. §103(a) over Bunke and Saund and further in view of U.S. Patent 5,511,148 to Wellner. These rejections are respectfully traversed.

Bunke, Saund and Mack, alone or in combination, fail to teach or suggest an image storage method comprising projecting a pattern by a projecting part along an optical axis direction, picking up an intensity image and a projection pattern image by a first image pickup part deflected from an optical axis direction of the projecting part by a half mirror, and picking up the projection pattern image by a second image pickup part from a direction different from the optical axis direction of the projecting part, creating first range information based on the pattern picked up by the second image pickup part, performing geometric transformation for the intensity image produced by the first image pickup part based on the range information, storing an initial geometric-transformed intensity image in a time-series transformed in the geometric transformation step, making comparison between successive geometric-transformed intensity images in the time-series transformed in geometric transformation step, and retrieving only differential data between successive geometric-transformed intensity images in the time series as storage data based on a result of the

comparison of the comparison step of the initial geometric-transformed intensity image and geometric-transformed intensity images subsequently transformed in the time-series, as recited in claim 9. These reasons extend to claims 10-12 and 14-16 based on their dependence from claim 9.

Further, Bunke and Saund, alone or in combination, do not teach or suggest an image processing apparatus comprising a projecting part that projects light from a baseline to an image holding medium to form an image thereon, the projecting part associated with a re-coding part that creates a code imposed in the image, an image pickup part that picks up the image on the image holding medium projected by the projecting part, the image part includeing a decoding part that detects the code created in the re-coding part, an intensity image acquisition part that acquires an intensity image based on the image picked up by the image pickup part, a range information acquisition part that acquires range information from the picked-up image by determining a distance between the image holding medium and the baseline based on the code, a geometric transformation part that performs geometric transformation for the intensity image based on the range information acquired in the range information acquisition part, an image extracting part that extracts difference between a geometric-transformed intensity image and an intensity image acquired in advance, a storage part that stores, as the geometric-transformed intensity image, an initial geometric-transformed intensity image in a time-series transformed by the geometric transformation part, the image extracting part making comparison between successive geometric-transformed intensity images in the time-series transformed by the geometric transformation part, and an image processing part that retrieves only differential data between successive geometric-transformed intensity images in the time-series as storage data based on a result of the comparison of the image extracting part of the initial geometric-transformed intensity image and geometric-transformed intensity images subsequently transformed in the time-series, wherein the stored geometric-transformed intensity image is the initial geometric-

transformed intensity image and the differential data between successive geometric-transformed intensity images in the time-series, as recited in claim 17, and similarly recited in claim 38. These reasons extend to claims 18-26 based on their dependence from claim 17.

Nor do Bunke and Saund, alone or in combination teach or suggest an image processing method comprising projecting light from a baseline to an image holding medium to form an image thereon, creating a code to be imposed in the image, picking up the image projected on the image holding medium and decoding the code imposed in the image, acquiring an intensity image based on the image picked up in the image pickup step, acquiring range information from the picked-up image by determining a distance between the image holding medium and the baseline based on the code, performing geometric transformation for the intensity image based on the range information acquired in the range information acquisition step, and extracting difference between the geometric-transformed intensity image and an intensity image acquired in advance, storing, as the geometric-transformed intensity image, an initial geometric-transformed intensity image in a time-series transformed in the geometric transformation step, making comparison between successive geometric-transformed intensity images in the time-series transformed in the geometric transformation step, and retrieving only differential data between successive geometric-transformed intensity images in the time-series as storage data based on a result of the comparison step of the initial geometric-transformed intensity image and geometric-transformed intensity images subsequently transformed in the time-series, wherein the stored geometric-transformed intensity image is the initial geometric-transformed intensity image and the differential data between successive geometric-transformed intensity images in the time-series, as recited in claim 27, and similarly recited in claim 39. These reasons apply by extension to claims 28-36 based on their dependence from claim 27. Similarly, these deficiencies of Bunke and Saund extend to a storage medium for an image processing method

including feature steps similar to those recited above, as recited in claim 37, and similarly recited in claim 40.

Instead, Bunke discloses a handwriting recognition method. In particular, Bunke teaches determining an ink trace from writing by temporal differential image processing, compensating for shadows and occlusions. Bunke discloses a technique for reconstructing the pen trajectory by extracting changes between sequential images and maintaining an aggregated image to exclude a change from repeated subsequent recording (§2.1 and Figs. 1and 3 of Bunke).

Also, Saund discloses a book scanner with image skew compensation (and the cited but non-applied U.S. Patent 5,760,925 to Saund *et al.* also teaches a book scanner). In particular, Saund teaches a scanning system 4 that scans a bound document 10 along a scan line 51 angularly offset from the spine 11 along which the document 10 is bound. The scanning system 4 includes a platform 8 on which the document 10 is openly disposed, a frame 12 that supports light sources 13 and a scanning assembly 14, and a camera 15. The scanning assembly includes a scan bar 16, a lens assembly 18, a mirror 19 operated by a motor 20, a scan controller 22, and an image processing system 28 to compensate for image distortion that result from the orientation and uneven shape of the document pages by scan line buffers 45-48 (col. 5, lines 4-30, col. 7, lines 25-47 and Figs. 1 and 5 of Saund).

As discussed above, Mack discloses converting stereoscopic images into three-dimensional models. In particular, Mack teaches a 3-D imaging device system 10 having left and right imaging devices 12, 13 to capture an image of a target object, a light device to project a light beam, a diffracting device 17 to split the beam into a structured pattern of lines, a filter 18 to code the lines, and a computing device 19 to process the imaging data into a stereoscopic image (col. 3, line 43 – col. 4, line 59 and Fig. 1 of Mack). Also, Mack teaches that the light source 16 may emit light in the infrared region rather than visible light,

particularly when obtaining textural data (col. 5, lines 25-32, col. 6, lines 15-39 and Fig. 2 of Mack).

Batlle does not compensate for the deficiencies of Bunke, Saund and Mack outlined above for claim 9. Nor does Batlle teach, disclose or suggest the additional features recited in claims 10 and 15 that include assigning new code corresponding to the pattern picked up by the first image pickup part, creating the first range information from the pattern picked up by the second image pickup part based on the new code, and creating second range information by deriving a correspondence between intensity information obtained by the first and second image pickup parts for pattern changes less than a predetermined value. Instead, as discussed above, Batlle discloses techniques for codification of projected patterns. In particular, Batlle teaches transformation from a captured point P_1 based on an object point P_0 to a projected point P_2 using a global coordinate system O (§§4.1-4.3 at pages 965-966 of Batlle). Also, Batlle teaches projecting patterns of laser beam dots, captured by cameras either simultaneously with filters or else sequentially (§6.1 at pages 969-971 and Fig. 3 of Batlle).

Also, Stolfo does not compensate for the deficiencies of Bunke and Saund outlined above for claims 17 and 27. Nor does Stolfo teach, disclose or suggest the additional features recited in claims 21-24, 26, 31-34 and 36. These include a document database for storing document format data, and a document identifying part for matching the geometric-transformed intensity image and the document format data stored, as provided in claim 21; as well as an authentication information database for storing handwriting history data of registered users, and an authentication processing part for inputting the geometric-transformed intensity image and matching the input image and handwriting history data, as provided in claim 23; along with a storage part for storing range information acquired by the range information acquisition part for intensity range geometric transformation, with a fixed distance between the image holding medium and the image pickup part, as provided in claim 26, and similarly provided as method steps in claims 31, 33 and 36. Instead, Stolfo discloses

a method for image compression. In particular, Stolfo teaches comparing a scanned check image against a database, subtracting the pixels that match within a threshold λ as a second image to be identified by an index code, thereby compressing the necessary information to be stored (col. 14, line 20 – col. 15, line 65 and Fig. 1 of Stolfo).

Applicant submits that the absence of Wellner from the forms PTO-892 issued with the Final Office Action and the previous July 29, 2004 Office Action, renders its application as a reference as improper. Moreover, Wellner does not compensate for the deficiencies of Bunke and Saund outlined above for claims 17 and 27. Nor does Wellner teach, disclose or suggest the additional features recited in claims 25 and 35. These include a display part for displaying an image produced from geometric transformation for the intensity image, based on the range information in the geometric transformation part, as provided in claim 25, and similarly provided as a method step in claim 35. Instead, Wellner discloses an interactive copying system. In particular, Wellner teaches a signal processing system 10 that receives image data from a document 4 through a camera 6 and displays a new document 20 by a projector 8 (col. 6, lines 2-17 and Fig. 1 of Wellner). In addition, Wellner teaches user interface techniques for indicating a selection block 24 on the document 4 by finger movement to insert into the new document 20 (col. 13, lines 2-42 and Figs. 6(a)-6(b) of Wellner).

Further, there would not have been proper motivation to combine features related to the pen trajectory reconstruction of Bunke with the image skew compensation of Saund, the coded structured light of Mack, the coordinate transformation and pattern projection of Batlle, the coded image compression of Stolfo and/or the finger movement block selection of Wellner, nor has the Final Office Action established sufficient motivation for a *prima facie* case of obviousness. The applied references address separate problems that lack any clear association that would induce a person of ordinary skill in the art to combine their teachings, much less to achieve Applicant's claimed features

For at least these reasons, Applicant respectfully asserts that independent claims 9, 17, 27 and 37-40 are now patentable over the applied references. The dependent claims are likewise patentable over the applied references for at least the reasons discussed as well as for the additional features they recite. Consequently, all the claims are in condition for allowance. Thus, Applicant respectfully requests that the rejections under 35 U.S.C. §103 be withdrawn.

VI. Conclusion

In view of the foregoing amendments and remarks, Applicant respectfully submits that this application is in condition for allowance. Favorable consideration and prompt allowance are earnestly solicited.

Should the Examiner believe that anything further is desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact Applicant's undersigned representative at the telephone number listed below.

Respectfully submitted,

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JAO:GWT/gwt

Attachment:
Replacement Drawing Sheet (Fig. 9)

Date: April 21, 2005

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DEPOSIT ACCOUNT USE
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